STRATEGY RESEARCH PROJECT

THE EVOLUTION OF SIGNAL DOCTRINE

BY

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ABSTRACT

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The purpose of this paper is to track the evolution of signal doctrine from World War II to the present day. While signal doctrine has evolved through conflict, and technology, there have been enduring signal principles that have shaped present signal doctrine and are the key to the signal doctrine of the future.

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'The road to hell is paved with the bodies of Signal Battalion Commanders who were doctrinally correct. The best practicioners of Signal Doctrine are relieved Signal Battalion Commanders.'

Major General Sutten,
United States Army Signal Corps

INTRODUCTION

With the Information Age upon us, many are proposing new signal doctrine based on technology. So now it is important to review signal doctrine and to see what, if any, lessons can be learned from tracking its evolution. While signal doctrine has evolved through conflict, changing along with Army doctrine and technology, certain key principles of signal communications are so universal that they have endured from World War II to the present day. **Continuity of command and control communications, integrated signal communication systems, autonomy, speed (both of installation and transmission), flexibility, reliability, use of alternate means of communications, simplicity, connectivity,** and **security** have remained as enduring principles. While other principles have been added through the years according to the demands of the times, it has been these key principles that have shaped the overall formation of signal doctrine and have allowed signaleers to innovate solutions to combat problems. These key principles can likewise provide beacons for what the signal doctrine should be for the 21st century.

What is doctrine? Headquarters, Department of the Army (DA) defines Army doctrine as those fundamental principles by which military forces guide their actions in support of national objectives. Doctrine then provides a "philosophical underpinning" for tactics, techniques, and procedures (TTP). Tactics govern how a unit is employed in combat. Techniques are methods soldiers use to perform their duties. Procedures prescribe the ways of carrying out particular courses of action. Normally, Army manuals deal with tactics, techniques, and procedures together. So doctrine provides the basic principles, while TTP describes how best to apply these principles in actual operations. Good, solid doctrine that is well understood by our soldiers allows them to innovate when the situation requires it. When doctrine is inculcated and problems arise which cannot be easily solved by TTP, soldiers have to act situationally, relying on the key principles, and innovate. Effective innovation is based on a sound understanding of doctrinal concepts.

THE SECOND WORLD WAR

At the beginning of WWII, the principles of signal communications were not originally documented in signal manuals. Rather they were found in the more general 1941 Army doctrinal manual, FM 100-5, Field Service Regulations, Operations, 100-5. This manual declares that, "The authority to issue orders is an

inherent function of command. Orders are normally issued to next subordinate commanders."[1] This is the paramount concept around which all signal principles are built, because authority can be enacted only by transmitting the commander's order to his subordinate commanders. Therefore it is the fundamental exercise of command that drives the first signal principle: Get the order/message through, an action which establishes the requirement for the principle of **continuity of command and control**. This has always been the primary mission of the Signal Corps.

Other signal principles are clearly defined in FM 100-5 in a section titled Signal Communication.

> The efficient exercise of command and the prompt transmission of information and instructions require the establishment of **reliable means** of signal communication. Signal communication is effected by technical means and by messengers. Entire dependance cannot be placed upon any one means; **alternate means** must be provided.
>
> Every commander is responsible for the establishment and maintenance of the signal communication system of his unit and for its efficent operation as a part of the system of the next higher command. (*The principles of autonomy and integrated systems.*) Signal communication systems must be **simple, flexible,** and properly used.
>
> The establishment and maintenance of signal communication between superior and subordinate units is the responsibility of the superior commander; between adjacent units, as directed by their common superior. A unit supporting another by fire is responsible for the establishment and maintenance of signal communication with the supported unit. (*The principle of connectivity.*)
>
> The various means of signal communication are so employed that they supplement each other. (*The principle of integrated systems.*) Those requiring great expediture of effort and material are not installed when the service required can be effectively performed by less elaborate means. (*The principles of simplicity and speed of installation.*)

Wire communication constitues the basic technical means of signal communication. Rapidly changing situations, such as pursuit or retreat, restrict the practicability of its employment. The possiblity of failure to function in critical situations must also be reckoned with. A wire system must, therefore, be supplemented by other means. Although wire communication is a relatively safe means, there is always the possibility of hostile interception. It is inadvisable to employ wire communication for the transmission in clear text of plans which are not to be executed immediately. (*The principles of speed of installation, flexibility and security.*)

Radio communication is especially applicable in spanning distances between widely separated mobile forces, between ground and air, and in the fire-swept zone of the forward area. It is subject, however, to static, to hostile interference, to interception, and to location by the enemy. Interception of radio messages must be presumed. (*The principles of speed of installation, speed of transmission, and security.*)

Sole reliance cannot be placed upon the technical means of signal communication. Their absence or failure to function does not relieve the commander of his responsibility of keeping higher, lower, and adjacent units informed of the situation. Each commander provides for the transmission of orders, information, and reports by means of messengers. (*The principle of alternate means.*)

All of these enduring principles are cited in the 1941 FM 100-5.[2] At the outset of World War II, Army doctrine drove signal corps doctrine.

If signal doctrinal principles were incorporated in Army doctrine, then what was being written by the Signal Corps? The first signal field manuals of WWII were FM 11-5, Mission, Functions, and Signal Communication in General, (1940), and FM 24-5, Basic Field Manual: Signal Communication, (1942). FM 11-5 focused on signal missions and functions, along with the role of the signal officer. FM 24-5 concentrated on the means of signal communications, prescribing how headquarters would be supported.

Basically these two manuals comprised the basic signal TTP, which were amplified in additional signal manuals for organization and operations in the infantry division, airborne division, and other organizations. These signal operations manuals described in great detail the means of signal communication, but they do not mention key signal principles. The means of signal communication specified the manner in which messages were transmitted. At this time this manual described the means of signal communication as messenger, pigeon, radio, visual, sound, and wire.[3]

Many technological changes emerged during WWII. A lighter cable was introduced with a new sheathing, which was less tempting to chew on by cows, goats, and pigs. New lighter walkie-talkie radios, and a lighter, more reliable switchboard were also developed. A multichannel Very High Frequency (VHF) radio was developed. Radios and wire communications were both used from the very beginning of WWII. New improved radios increased their range and their reliability, but these improvements did not remedy their lack of security. The same was true of the multichannel radio relay links which were used in the communications zone (COMMZ) to provide the backbone of the Army area tactical communication system until cable and wire systems could be installed. However, the COMMZ was sufficiently in the rear so that the lack of security was an acceptable risk. But the doctrine didn't change, since the technological changes

simply improved the effectiveness of the electronic communications means, wire and radio.

The key doctrinal principles, well documented in the Operations FM, were known and understood by signaleers. Consider the measures they took to get the message through. When General Patton wanted to ensure his attack order was explicitly understood by his subordinate commander, his signaleers installed a single wire line of 17 miles to transmit the order.[4] The order was effectively transmitted. The attack commenced on time and was successful. The need for continuity of command and control communications (get the message through) was both understood and achieved. In this case, successful continuity demonstrates that the requirements for security and simplicity were also understood.

POST WORLD WAR II AND KOREA

After WWII, the Signal Corps published new manuals. In 1948, Ft. Monmouth Signal School officers were given a new handbook to assist them with their duties. It covered electrical fundamentals, radio and wire principles, applied communications, and signal center operations. But it did not discuss the key signal doctrinal principles.

One of these manuals, Field Manual 100-11, Signal Communications Doctrine, tells us,

In modern warfare, no commander can exercise command of more than a handful of men by his physical presence. To receive information upon which to base his decisions, to transmit his commands, to secure the supplies and munitions for carrying out his plans, he must rely upon signal communications. In this day of dispersion of enormous forces, rapid signal communications are virtually synonymous with electrical communications. A commander who is out of communication with a subordinate unit has lost control of that unit until he reestablishes electrical communication with it. It follows that signal communications are vital to the exercise of command and that each commander must feel deeply responsible for the successful operation of his signal communications.[5]

The principle of continuity of command and control communications could not have been better stated. The manual goes on to describe the principles of integrated signal communications systems and responsibility for connectivity for adjacent and supported units. The principle of security is also described at great length. The manual then discusses the duties of the signal officer and means of communications. A further reference to doctrinal principles comes in the discussion of the employment of various means of signal communications. The manual reminds officers and signaleers to consider the speed of installation, noting which facilities may be made available to the commanders at first need. It cites signal communications security measures which permit the freest and fullest use of the facility installed. While not all the principles are not specifically listed, most can certainly be derived from a reading of this 1948 narrative text.

A new edition of FM 24-5, Signal Communications, was published in August 1950. This FM focused on the signal TTP. It lists the various means of communications: messenger, wire, radio, pigeon, visual and sound. In the discussion of their employment, the manual assesses how well various means of communications observe the key principles of signal doctrine. But again, the key signal principles themselves are neither listed or defined. The concept of the key principle of continuity of command and control communications pervades the manual. Likewise, security is also emphasized. And as in FM 100-11, signal principles of speed, flexibility, and reliability are implied throughout the manual as considerations when selecting the signal means in a given scenario.

Korea burst upon the international scene when America had already reduced its military strength to a fragment of its WWII power. The Signal Corps was a skeletal organization. This conflict has been depicted as a series of wild, 'cop and robbers' kinds of fights. Rice paddys and population centers changed hands so frequently that only the most mobile of communications were practical, even at division level. Mountainous terrain and extreme weather plagued operations as well. Not all the signal TTP was usable in such an environment. After the conflict, in July 1952, a Combat Communications Team from the Operations Research Office of Johns Hopkins University was sent to Korea to examine the communications system to determine its structure and

shortfalls. Three factors of major importance were found. First, there was no doctrine to integrate Army-wide telephone networks. Second, security procedures were slow and cumbersome. And third, the addressing and handling of written messages also presented problems.[6] Signal personnel knew key principles, but the signal TTP was not sufficient.

For the signal soldier, the best guidance for accomplishing his mission was found in the use of key doctrinal principles of signal communication: get the message through (continuity) quickly, reliably, securely, simply, using whatever alternate communication means were available. The primary means of communication remained messengers, pigeons, radio, wire, visual, and sound communications. But the individual signal soldier brought success to the communications mission in Korea because of his ability to innovate. Successful innovation comes when soldiers apply key principles in new ways to solve unanticipated problems. These signal soldiers in Korea did just that!

Some of their accomplishments may seem simple. For example, VHF radio relay equipment was so heavy that in many cases jeeps couldn't haul it up the steep slopes. So the signal soldiers carried it on their backs.[7] But their labors enacted the key doctrinal principle of continuity of command and control communications. They got the message through. This principle was so internalized in the soldiers that they did whatever was required! More technical innovation was demonstrated by Captain

John Pierce of the 24th Signal Company. He said that although U.S. Army doctrine taught that wire is the primary method of signal communication because of security, reliability, and other issues, he did not observe this in Korea. There, the Army had to depend much more on VHF radio relay links. Distance, speed, terrain, and road nets were not conducive to the primary use of wire systems. They also found out that they could 'bend' the radio signals at lower frequencies to get around steep hills. Sometimes they 'banked' the radio shots off the steep slopes--these procedures were not found in Army textbooks![8] In fact, most of the time in Korea wire communication systems weren't even installed. And when they were, the wire often had to be laid out by airplane. TTP may have been lacking, but the signal soldiers' understanding of the key signal principles led to innovation and success.

The internalization of the foremost signal communication principle was best expressed by a Master Sergeant who put it this way:

"Yeah, there was a lot to grouse about in Korea, but all I could do was listen to them beef, and then ask, are the circuits in? I didn't care how much they growled as long as they got those circuits in."[9]

VIETNAM

Ten years elapsed from the end of the Korean War to the entry of the U.S. Army Signal Corps into Vietnam. No new signal doctrinal manuals had been written. The first signal unit to arrive in Vietnam in early 1962 was the 39th Signal Battalion. Its task was to install a country-wide communications system to provide command and control over the new U.S. operational support and advisory mission to the Republic of South Vietnam. The 39th accomplished their mission with a backbone tropospheric scatter radio system. This new development provided long-range, high-capacity communications beyond line-of-sight (LOS). Service was provided to the ground forces through a series of telephone switchboard exchanges and comm centers. The 39th also provided an HF radio net (AN/GRC-109s) utilizing International Morse Code continuous wave (CW) for connectivity between the village defense forces. A commercial amplitude modulated (AM) radio net (TR-20s) was set up for use by the American advisors.[10]

In 1965, the Signal Corps finally published FM 24-1, Tactical Communications Doctrine, to replace the 1948 FM 100-11, Signal Communications Doctrine. It was long overdue. Much of the language used for defining tactical communications responsibilities was taken directly from the 1941 FM 100-5, Operations. FM 24-1 is the first signal manual that dedicates a section that lists and discusses key signal communication

principles. The names of some of the principles have changed. Some new principles have been added. FM 24-1 cites the following principles: restricted use of communications means for the commander and his designate; use of appropriate communications means by weighing factors of operational urgency, time and reliability; flexibility to be able to adjust to changes in mission, or the tactical situation; dispersion of signal assets to increase survivability (*a new principle*); operational simplicity in systems and procedures; organic means of communications for each unit headquarters appropriate with its requirements, or autonomy, compatible with the Signal Corps provided common-user communications system; and maximum communications security by employing every safeguard consistent with the operational requirements. A new responsibility for connectivity was added--common communications support. This concept had been previously implied by the theater area communications system to support the COMMZ, but it had never before been stated as a specific responsibility.[11] This concept would evolve in the future into an entire tactical architecture based on area common user communications support and made possible with the acquisition of Mobile Subscriber Equipment.

The key principles of continuity of communications/get the message through, reliability, security, speed, flexibility, and simplicity are evident in this 1965 manual. For instance, when discussing considerations for employment of communications means,

FM 24-1 describes the principles of reliability, security, and speed as follows:

> **Reliability** in communications is that probability of a communication device performing its mission adequately under the operating conditions expected to be encountered in a variety of tactical and non-tactical situations. To assure reliability in tactical communciations, there must be adequate planning to minimize disruptions.
>
> **Security** includes all aspects of communications security, which includes crypto-security, physical security, and transmission security.
>
> **Speed** in communications is essential in order to place required information or instructions in the possesion of the appropriate agency to enable it to take action in the least possible time. Speed is attained by the optimum combination of well-trained personnel employing the most effective procedure with the proper equipment. Speed is highly desirable, but not necessarily at a sacrifice of reliability or security.[12]

This 1965 manual acknowledges an archaic means of signal communication. After many years of outstanding service, the pigeon corps was eliminated as a feasible means and replaced by the expanding pictorial and audio-visual field, which included photography, facsimile, and television.[13]

Vietnam changed the application of much doctrine. Military Assistance Command Vietnam (MACV) dictated command and control requirements to individual brigades and battalions operating in the remotest regions, thereby flattening out the chain of command. On the signal side, divisional signal battalions didn't have a corps signal system to connect into; instead they connected into the systems of the 1st Signal Brigade. The 1st Signal Brigade tied everything together throughout the entire area of operations, including MACV, Vietnam, and the U.S. Army.

They even connected into the division support links themselves, because the divisional signal battalions couldn't handle the huge geographic span of control. The 1st Signal Brigade grew tremendously. By 1968 it consisted of 23 battalions and 8 separate companies, and was commanded by a Major General.[14] This unprecedented growth violated the principle of simple, integrated signal systems, causing problems with signal span of control.

Initial combat experiences of 1st Cavalry and 1st Infantry Divisions also highlight this difficulty of maintaining command and control throughout an expanded division area of operations. The use of FM radios over a larger tactical area of responsibility posed a problem that persisted throughout the entire Vietnam conflict.[15] The flattening of the chain of command eliminated integrated systems, causing existing systems to be extended beyond their normal range. Security became even more of an issue because rapid concentration of forces in remote areas could not be accomplished without the use of the radio. Entire operations became compromised. A new development, KY-8s, cryptographic devices to secure the FM radio links, was fielded. But it didn't function well. A new version, KY-38s, came on the scene in 1967, and was supported by an entire new organization, the Communications Security Logistics Support Center. Although smaller and more user-friendly than the KY-8, KY-38s were not used either because they were still too heavy, or because their crypto-keying procedure presented too many problems.[16] The

principle of security was transgressed throughout the Vietnam conflict.

In 1968 the Signal Corps came out with another revision of FM 24-1, Tactical Communications Doctrine, exactly three years and a day from issuance of the previous manual. It opened by stating that a tactical commander needs a reliable, secure, responsive, and flexible communications system to command and control his widely dispersed, mobile tactical forces. Chapters and topics are switched around, but the 1968 edition did not significantly change the 1965 manual.

A first-ever strategic satellite communications link connected a first ever strategic satellite communications link connected Southeast Asia, Hawaii, and Washington DC. But on the tactical side, modernization of equipment was slow. The same basic radio systems were used throughout most of the protracted ten-year conflict. In a time span twice that of WW II, there were no corresponding increases in technology on the tactical side. The promise of tactical satellite systems never arrived, and switchboards remained slow and non secure. Crypto keying of tactical security devices presented logistic and operational problems from the beginning. Preparation and transmission of situation reports (SITREPs) proved to be so awkward and cumbersome that messengers were often used in lieu of electronic means. The key doctrinal signal principles remained viable

throughout the Vietnam War--however, sometimes only realized through their neglect.

THE EUROPEAN THEATER OF THE COLD WAR

During the ten years of the Vietnam War, the Cold War continued. But the open warfare in Southeast Asia definitely had center stage. Following the U.S. exodus from Vietnam in 1972-75, there was an obvious change of interest to the European theater. The end of the war in Vietnam also brought an end to the conscription force, which was replaced with a volunteer Army (VOLAR). Army operational doctrine for Europe centered around the mobile defense: trade terrain for time while readying reserve forces for a counterattack in order to seize the initiative. The enemy was the Soviet Union, which both militarily and technologically was our only competing superpower. It possessed a very large and capable force with the latest in modern weaponry. The U.S. Army had to overcome its Vietnam obsession with small unit tactics and relearn theater army tactics for the possibility of general war.

The new version of the Signal Corps doctrinal manual, FM 24-1, Combat Communications, was published in September 1976. It radically departed from its predecessors. It was part of the 'How To Fight' series. Written for the VOLAR soldier, its format featured lots of cartoon pictures, supported by sports analogies.

A 'how to' manual, it describes the planning process of how to balance requirements with capabilities to achieve success. It discusses tactical signal system requirements and planning characteristics, which include the key doctrinal principles of continuity of command and control communications, speed, reliability, flexibility, multi-means/alternate means, integrated systems, and security.[17] Further, it cites signal responsibilities of connectivity, higher to lower, supporting to supported, reinforcing to reinforced, and left to right. The means and modes of signal communication are combined: radio, wire and cable, multichannel, teletypewriter and radio teletype (RATT), continuous wave and international morse code, facsimile, data systems, tacsatcom, audio-visual, radio wire integration (RWI), visual and sound, messenger, radar, and signal security techniques.[18] This manual emphasizes the need for 'jointness,' which had fallen into a period of dormancy since WWII when joint Army-Navy publications (JANAPs) and joint army marine signal equipment were developed. It also identified the new capability of 'state of the art' communication systems to interface, which blurred the old distinction of strategic and tactical systems[19].

By the end of the 70s, some major changes within the Army were taking place. Technology changes focused on communications security. Computerized signal operating instructions (SOI) and new communications security devices for radio and wire were developed. The VINSON security devices for FM single-channel

radio designed during Vietnam were finally produced; they secured all command and control, operations, intel, and fire support radio nets. These developments greatly helped to achieve the principle of security, thereby eliminating a concern that had lingered since the Vietnam War.

The Army was very concerned about its ability to accomplish its objectives of winning the first battle in Europe and winning while outnumbered. A major shift in overall Army doctrine came with the advocacy of AirLand Battle doctrine in the 1982 version of FM 100-5, Operations. This monumental work drastically changed the way the Army thought about itself. The concepts of winning, the spirit of the offense, and gaining the initiative are infused throughout. New principles of warfighting (initiative, depth, agility, and synchronization) were developed. In a number of places, this manual suggested that effective command and control communications (C3) may be more difficult than ever, primarily due to electronic warfare and modern electronic countermeasures.[20] It acknowledges that "Communications on the contemporary battlefield will be uncertain."[21] It emphasizes the key signal communication principle of survivability because of the threat of enemy EW efforts, terrain, atmospheric conditions, and nuclear electromagnetic pulse (EMP). FM 100-5 (1982) concludes with an almost prophetic discussion of joint, contingency, and combined operations. Regarding contingency operations, it warns that a

lack of adequate communications and intelligence may hamper the initial phase of the operations. It recommends that forces establish long-range communications early to ensure an effective flow of information for decision making[22]. Very soon AirLand Battle doctrine would be tested in Operation Urgent Fury, Grenada.

OPERATION URGENT FURY, GRENADA

The communications lessons of Grenada have been painfully symbolized by the vivid picture of the soldier using his own personal AT&T charge card to call for fire support. Despite the doctrinal trumpet that called for a joint approach from the earliest beginnings of WWII, the services could not interoperate on the level that counted, the tactical level. Our military performance at Grenada led to the Goldwaters-Nichols amendment of 1986, which mandated the joint approach to all warfighting. And it was Grenada that brought the new term of **interoperability** to the signal doctrinal lexicon.

Some have said that Grenada was not a communications failure, but a failure of the planners who neglected to bring communicators into the planning until within 24 hours of the operation. Army Signal Corps contingency planning for that geographical area wasn't even considered because of the exclusion of key people from the JTF staff, of fluctuating mission

requirements, and of inadequate planning time. Hence the operation suffered from the inability to communicate up and down and across the chain of command. Everything that could go wrong, did. There was no joint contingency commo plan, no coordinated frequency plan. Consequently the JTF operated with incompatible frequencies. Incompatible Army and Navy crypto equipment caused problems in requests for naval gunfire support. Air support from the USS Independence was delayed because of incompatible messaging formats. All the services were criticized for their inability to plan and interoperate as joint forces. DOD thus addressed systemic problems and initiated changes to improve joint operations. The Joint Tactical C3 Agency was established in 1984. It made great strides towards communications interoperability--message formats were standardized and the tri-service tactical communications system (TRI-TAC) was developed, making tactical comms between the Air Force, the Marines , and the Army much more compatible.[23]

RESPONDING TO AIRLAND BATTLE DOCTRINE

Concurrently, in response to AirLand Battle doctrine, the Signal Corps rapidly acquired Mobile Subscriber Equipment (MSE), a new communications system to support the Army Tactical Command and Control System. MSE provided an area common user secure system which could be accessed by either fixed or mobile

stations. The network provided a flood search switching plan; now commanders could traverse the theater and make a call into the network from anywhere, automatically. More dramatic changes followed. May 1986 brought a revision of AirLand Battle (ALB) doctrine which stressed that the command and control system must be reliable, secure, fast, and durable. The command and control system is the key to the execution of ALB doctrine[24]. Similarly, Army Regulation 25-1 created the Army Information Mission Area (AIMA), which was assigned to the Signal Corps. AIMA consisted of the five disciplines of communications, automation, visual information, records management, and printing and publications. The Signal Corps responded to these changes with a dramatic change of their own. When the coordinating draft of the signal doctrinal manual, FM 24-1, was sent to the field for comment in December 1988, General Gray, soon to be Chief of Signal but then still Deputy Commander, made a special appeal. He wanted to ensure that this emerging manual covered historic doctrinal responsibilities and principles; he also wanted it to reflect the new areas of responsibility from the assignment of the AIMA. This manual would serve as the baseline document for the Signal Corps. General Gray wanted it to be comprehensively on target.[25]

OPERATION JUST CAUSE, PANAMA, AND THE GULF WAR, OPERATION DESERT SHIELD/DESERT STORM

The manual was not published as a final document before the Army was involved in two more major operations, Operation Just Cause in Panama, and Desert Shield/Desert Storm in the Gulf. The invasion of Panama during Operation Just Cause broke just one year later after the distribution of the coordinating draft of FM 24-1, in December 1989. The signal support system was provided by the 82nd Signal Battalion, the 154th Signal Battalion, and elements of the 1109th Signal Battalion, which provided strategic support. Although many wanted to cite Operation Just Cause as proof of improvements in joint operations, U.S. forces primarily used the U.S. Southern Command in-place communications infrastructure. There was a mature joint operating plan. And an extensive communications/information management network was in place at the time of the invasion, including a strategic SATCOM system of four satellites, a submarine cable for international communication, and a microwave radio and cable system. The internal communication structure, combined with the pre-invasion communication build-up, provided an extremely robust communications situation. But the majority of the JTF was Army, one service. So the possibility of any communications interoperability problems were greatly reduced.[26]

Eight short months later, Operation Desert Shield/Desert Storm (DS/DS) was triggered by Saddam Hussein's invasion of Kuwait. DS/DS was different from Operation Just Cause in every way: size of the force, capability of the enemy, size of the theater, jointness of the operation, and allied combined operations.

DS/DS has been proposed as a prototype of how to fight a Major Theater War (MTW). Indeed DS/DS offered many signal lessons. Corps signal brigades were not resourced equally. MSE provided combat customers with their own 'user owned and operated' information and communications equipment. However, MSE did not work for the area signal support system for echelons above Corps (EAC) missions in the COMMZ because the different customer units there did not have 'user owned and operated' information and communications equipment. Also, the manner in which the conflict built up created a void in the communications planning. When the decision to go to offensive operations was made, the signal planners realized that a theater signal structure was required. Then came a mad dash to get combat equipment into theater. The resultant signal network was put together in a somewhat herky-jerky fashion. Outstanding communicators improvised. In the words of Major General Sutten, then commander of the 6th Signal Command, "The principles of signal doctrine from WWII: flexibility, redundancy, and use of

multiple means were validated and achieved during Desert Shield/Desert Storm."[27]

SIGNAL SUPPORT IN THE AIRLAND BATTLE, FM 24-1

The new FM 24-1, Signal Support in the AirLand Battle, was finally published during DS/DS in October 1990. This manual implements the AIMA through all levels of war. It is a hallmark work: The Chief of Signal's total intent is expertly conveyed.

A new term, **signal support**, is used to describe the collective integrated and synchronized use of information systems to support warfighting capabilities across the operational continuum.[28] The four operational principles of signal support are explained in depth, incorporating the enduring proven doctrinal principles into a new format of primary principles and subordinate elements.

The four operational signal support principles of **continuity**, **security**, **versatility**, and **simplicity** are all enduring key signal doctrinal principles which were first cited in the 1941 Army Operations doctrinal manual. Versatility is a new name for the old concept of flexibility. Versatility is defined as the ability to adapt readily to unforeseen C3 requirements. It includes subordinate elements of flexibility, interoperability, and autonomy--all of which have been

longstanding principles. Speed is included in flexibility. Interoperability also includes integrated signal systems.

Continuity provides the uninterrupted availability of information paths for effective command and control. It includes subordinate elements of survivability, reliability, redundancy, and connectivity. Responsibility for connectivity is governed by the age-old principles of senior to subordinate, supporting to supported, reinforcing to reinforced, and left to right. Common user support now requires that units in vicinity are supported by area signal nodes. A new responsibility relationship requires that the stationary units provide support to units conducting a passage of lines.

Security maintains the integrity of the force by supporting AirLand Battle tenets of initiative, agility, and synchronization; it also protects signal support and provides deception measures. It consists of information security (INFOSEC), physical security, dispersion, and deception.

Simplicity is the final signal support principle. It enables the commander and his staff to use and maintain their signal support easily; it is 'user friendly.' It provides technological sophistication with reliable equipment, while allowing simplicity of user operation and standardization.

Signal support is provided by five major means: radio; wire and cable; automation; visual and sound; and manual (includes messengers). The architecture of signal support is applied as an

area support system which supports the overall Army Command and Control System (ACCS). Through ACCS, Army force commanders employ and sustain military forces in a theater of operations. All planning and conduct of the signal support takes place 'jointly.' The common user area system is provided by nodal signal centers deployed in battlefield grids. The system utilizes signal networks and user-owned/operated terminals that accommodate all units in a given area, rather than being limited to a specific command. The common user area system also provides support to all units moving in/out of the theater as dictated by a fast moving, mobile combat situation. Given the exponential increase of requirements for processing, distribution, and communications of information systems; networking is the primary and most effective method for ensuring efficient, flexible, and survivable signal support.[29]

Along with this new doctrine, the Signal Corps also acquired a new combat net radio (CNR) called SINCGARS, which provides a frequency hopping plan for survivability and a much improved RWI capability that allows access into the common user MSE switching network as well. Tactical satellite communications for both single channel and multichannel capabilities is improved. Other data and transmission systems capable of wideband high volume transmissions have been acquired.

MULTI-NATIONAL PEACEKEEPING OPERATIONS

In The U.S. Army Signal Corps: Preparedness During the late Twentieth Century (1994), Dr. Stokes observes that reduction in the size of the military and use of technology as a force multiplier guarantee the Signal Corps a key role in Army preparedness for post-Cold War conflicts. But this key role depends on several factors: Central among them is the development of relevant doctrine for the post-Cold War era, supported by compatible equipment and systems that stand alone to provide all AIMA services in the most austere areas. The consensus among defense planners is that future U.S. involvement will probably take place in low-intensity conflicts, probably as part of a coalition force and/or with joint operations under the authority of NATO or the United Nations.[30] Multinational operations and support of UN peacekeeping missions indeed have become the new order of the day. How well is the new doctrine supporting these missions?

In December 1992, the U.S. military found itself in just this type operation in Somalia. Operation Restore Hope began as a humanitarian response to a ravaged country in disarray from the Somalian civil war. The U.S. provided the lead force under UN authority for Operation Restore Hope in the form of a Joint Task Force (JTF). An extensive liaison structure established the command and control of coalition partners. Current signal TTP

supported the joint communications network. It performed very well. However, the situation changed dramatically in May 1993 with the change of command to a UN multinational military force with a fully integrated multinational staff for Operation Continue Hope. The command and control structure changed from a U.S.-led coalition to a five-brigade multinational force led by LTG Bir, a Turkish general whose multinational staff came from approximately 28 different nations.[31]

The greatest command and control problem then became language. While the UN required all members of the multinational staff to have some fluency in English, there was no such requirement for the multinational brigades manning the sectors. So even when the multinational staff was able to transmit a message effectively, there was no guarantee that it would be effectively received on the other end. The second greatest problem was security. U.S. forces had encryption, along with some other western forces like the French and the Belgians. But the encryption equipment was not interoperable. The vast majority of coalition partners, including the UN Operations Somalia (UNOSOM) headquarters itself, had no choice but to communicate in the clear--zero security.[32] Very marginal information security was achieved through the production of new signal operating instructions on a frequent but irregular basis.

The communications network structure itself was a hodgepodge of UN-provided non-secure local 'handy talkie'

Motorola radios, some long distance high frequency (HF) radios, and local non-secure switched telephone service. Also, the U.S. provided a long-haul communications backbone with some U.S. provided telephone switching among the multinational staff.[33] There was no signal TTP for this situation, but the doctrinal principles provided sufficient guidance. The UN system was not interoperable with the U.S. system, so senior leaders had at least two different telephones on their desks. But this also provided a measure of redundancy. Alternate communications means gave additional redundancy and ensured a measure of continuity. Flexibility was achieved through providing UN telephone service across brigade national transmission systems. This was necessary because the UN telephone system was strictly local and the U.S. system was not compatible. Data communications were achieved primarily through dial up service--a Local Area Network (LAN) dependent upon UN-procured equipment. But this arrangement proved to be difficult due to the UN's sporadic equipment acquisition. In spite of all the problems, continuity of command and control was achieved through a layering approach of very dissimilar communications means. Again innovative professional communicators did the job, guided by long-standing doctrinal principles.

Haiti came quickly on the back of Somalia. This time the U.S., with UN sanction, sought to stabilize the legitimate government. In yet another U.S.-led coalition, the signal TTP

supported the communications requirements. Long haul communications were augmented by strategic and commercial means. Combined with organic corps communications, this arrangement provided a very effective C3 structure.

In July 1994, the cry to stop the dying in Rwanda brought a U.S. JTF from United States European Command (USEUCOM) into Operation Support Hope. The signal support architecture was designed and installed by an ad hoc organization built from the U.S. 7th Signal Brigade, the tactical Echelons above Corps (EAC) signal brigade for United States Army Europe (USAREUR). Layered military and commercial communications were used to achieve continuity through reliability and use of alternate means/redundancy. Signal TTP also successfully buttressed this signal support plan.

After much extensive prepatory planning, in December 1995 the U.S. entered yet another major operation--a North Atlantic Treaty Organization (NATO) led operation to support a cease-fire in war-torn Bosnia. A NATO coalition force using a very diverse variety of communications means/modes, including a UN communications network, achieved complete interoperability in every instance. Command and control was accomplished through an extensive video teleconferencing (VTC) network and very robust wide area networks (WANs) to move large amounts of data. For the first time, the principal use for the telephone switched network was to handle troop morale calls. The communications network to

support Operation Joint Endeavor (OJE) in Bosnia has been hailed as the most robust and complex ever attempted. Preparatory planning and exercises have shown quite a contrast between the Bosnia and Somalia operations. Continuity of command and control, simplicity, versatility, and security (to a lesser degree) have all been achieved in Bosnia.

CONCLUSION

The success of these recent operations certainly calls into question Dr. Stokes' finding that the Signal Corps needs a relevant doctrine for the post Cold War world. Present doctrine is relevant; it provides the necessary guidance. Security is difficult in networks with coalition partners, but adherence to principles leads to adequate solutions until technology can provide a better answer. Many commercial communications possibilities are looming on the horizon, promising better ways of achieving the principles of signal support. And while communications technology has changed, and is changing dramatically, we must remember that it has not been the driving force of doctrinal change. Rather technology has promoted greater efficiency and effectiveness of already existing means of signal communications. In fact, viewed broadly, signal support means have varied little from the early days of World War II. Wire and cable now include fiber optic and submarine cables.

Radio has incorporated satellite communications, meteor-scatter, extremely high frequency (EHF), and optical/light transmissions. Visual and sound devices are still practical means for local air-to-ground signaling and alarms; now visual and sound means include the presentation of visual images and sounds via TV, VTC, and photography. Automation means, newly added, provide methods for sending, receiving, processing, or storing information by an automated capability. And although messengers are seldom used nowadays, they are easily resurrected in emergencies; they are included among manual means, along with records management system.

From WWII to the present signal officers have been continuously challenged. Now more than ever before in our volatile, uncertain, complex, and ambiguous world, the road to hell will indeed be paved with the bodies of doctrinaire signal officers who have narrowed doctrine and constrained themselves to a set of absolute formulas. Reliance on dogma can only result in cadaverous automatons who have given up the ability to think. But those who have internalized the enduring principles of signal support and who are guided by them as they execute their responsibilities situationally will achieve success. The principles of signal support represent the culmination of observance of fifty years of signal doctrinal principles shaped by conflict, of newer principles recognized because of new threats or evolved from new technologies, and finally of those

that have endured at least from the beginnings of WWII--probably from much earlier. These are the universal doctrinal principles: continuity of C3, integrated signal systems, autonomy, speed, connectivity, reliability, redundancy from alternate signal means, flexibility, simplicity, and security. These principles have been enduring. Survivability and interoperability have also stood the test of time. Collectively, they remain keys to any future Information Age doctrine. Support of the warfighter has been and always will be the paramount concern for the development of signal corps doctrine. These principles have provided the necessary latitude to adapt to particular environments, situations, and emerging technologies. They have been the only guidance necessary when signaleers have fully understood them, inculcated them in their training and everyday activities, and internalized them in order to respond to the most dire situations. If the Signal Corps continues to promote and to train its personnel in these essential, enduring principles, then it will be ready for the Twenty-First Century.

,Word Count 7,182

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